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REMARKS

The application has been reviewed in light of the final Office Action dated Marcy 7, 2008. Claims 1, 2, 4, 6-10 and 12 were pending, with claims 3, 5, 11, 13 and 14 having previously been canceled, without prejudice or disclaimer. By this Amendment, claims 1 and 2 have been amended to include the features recited in original claim 5 (now canceled), and claims 15 and 16 have been added. Entry of the claim amendments is requested. Claims 1, 2, 4, 6-10, 12, 15 and 16 would be pending upon entry of this Amendment, with claims 1 and 2 being in independent form.

Claim 1 was rejected under 35 U.S.C. § 102(b) as purportedly anticipated by U.S. Patent No. 5,060,651 to Kondo et al. Claims 2, 4, 6-10 and 12 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Kondo in view of U.S. Patent No. 5,291,892 to O'Donnell.

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1 and 2 of the present application are patentable over the cited art, for at least the following reasons.

The present application relates to an ultrasonic probe of an improved configuration, devised by applicant. The ultrasonic probe includes a plurality of vibrator elements and a connection change over switch which successively changes over electrical connection of a first predetermined number of vibrator elements among the plurality of vibrator elements to be connected with the first predetermined number of ultrasonic wave transmission and reception channels. The connection change over switch is constituted in such a manner that each of the first predetermined number of the ultrasonic wave transmission and reception channels is connectable with a second predetermined number of the vibrator elements at the first predetermined number of intervals and the delay times of the ultrasonic wave signals transmitted

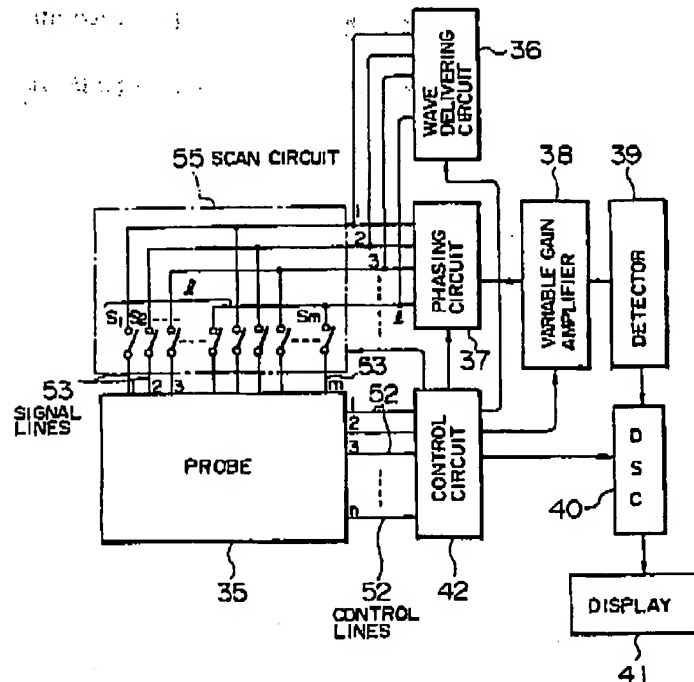
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and received from the first predetermined number of ultrasonic wave transmission and reception channels are set changeable at respective times.

Kondo, as understood by applicant, proposes an ultrasonic diagnostic apparatus including a probe (35) having a plurality of transducer elements arranged on a plane in two-dimensional directions, a bias applying unit for selecting the transducer elements in an arbitrary row in the horizontal direction to be in an operative condition by applying the same with a bias voltage, and a switching unit for selecting the transducer elements in at least one arbitrary column in the vertical direction by applying the same with a bias voltage, and controls the bias voltage applying unit and the switching unit to scan an ultrasonic beam in the two-dimensional directions to collect three-dimensional information on a body under inspection.

Fig 1 of Kondo is reproduced below:



In the apparatus proposed by Kondo, switch S1-Sm in scan circuit 55 select adjacent

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transducer elements from the *m* transducer columns. The selected adjacent transducer elements are connected to wave delivering circuit 36 or phasing circuit 37. The wave delivering circuit 36 delivers a wave delivering pulse to the probe 35 and is configured to converge the ultrasonic beam at a location a predetermined distance from the probe 35 by providing each channel with an *arbitrary* delay time. The phasing circuit 37 is configured to receive reflected echo signals of channels received by the probe 35 and to give a *predetermined* delay time to the echo signals to provide a sharp directing characteristic to a signal at a particular location.

The Office Action indicates that Kondo proposes that the time delay is capable of being unchanged, that is, time delay amount set in each channel are unchanged during the scanning.

Kondo does not disclose or suggest, however, that the connection change over switch is constituted in such a manner that each of the first predetermined number of the ultrasonic wave transmission and reception channels is connectable with a second predetermined number of the vibrator elements *at the first predetermined number of intervals* and the delay times of the ultrasonic wave signals transmitted and received from the first predetermined number of ultrasonic wave transmission and reception channels are set changeable at respective times (independent claims 1 and 2 of the present application).

Since each of the first predetermined number of the ultrasonic wave transmission and reception channels is connectable with a second predetermined number of the vibrator elements *at the first predetermined number of intervals*, the connection changeover switch in such subject matter can be miniaturized and cost for the connection changeover switch can be reduced. The cited art does not disclose or suggest such features nor the advantages thereof.

O'Donnell, as understood by Applicant, proposes an ultrasonic imaging system which produces simultaneously, and samples, three receive beams for each transmitted ultrasonic pulse

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directed upon flowing reflectors, wherein flow velocity is measured in the cross range direction using a correlation technique while flow velocity in the range direction is simultaneously measured using a Doppler method, and cross correlation is performed in both the range and cross range directions with data acquired from a set of such multi-beam acquisitions, in order to produce a B-scan image which indicates both magnitude and direction of the flowing reflectors.

The system of O'Donnell does not involve an ultrasonic probe and does not have a plurality of vibrator elements disposed in an array at the tip of the insert section around entire 360 degree outer circumference of the probe.

The cited art, even when considered along with common sense and common knowledge to one skilled in the art, does not render obvious an ultrasonic probe wherein the connection change over switch is constituted in such a manner that each of the first predetermined number of the ultrasonic wave transmission and reception channels is connectable with a second predetermined number of the vibrator elements at the first predetermined number of intervals and the delay times of the ultrasonic wave signals transmitted and received from the first predetermined number of ultrasonic wave transmission and reception channels are set changeable at respective times (independent claims 1 and 2 of the present application).

Accordingly, applicant respectfully submits that independent claims 1 and 2 of the present application, and the claims depending therefrom, are patentable over the cited art.

In addition, the cited art does not render obvious the above-mentioned ultrasonic probe of claim 2, further qualified that the number of vibrator elements in said plurality of vibrator elements divided by the first predetermined number equals the second predetermined number (claim 15 of the present application).

Such feature of claim 15 allows the delay times to be controlled with more ease,

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especially when the ultrasonic beam is formed by the vibrator elements comprising a highest ID number and a lowest ID number (see, for example, Fig. 5 of this application). In Fig. 5(a), vibrator elements 1 to 32 and 225 and 256 are used at the same time, and in Fig. 5(b), vibrator elements 1 to 33 and 226 to 256 are used at the same time.

Further, the cited art does not render obvious the above-mentioned ultrasonic probe of claim 2, further qualified that the delay times of the ultrasonic wave signals transmitted and received from the first predetermined number of ultrasonic wave transmission and reception channels are shifted by one from those immediately before.


Such features of claim 16 allow the ultrasonic delay amount at each channel to be changed regularly.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance, and earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any required fees, and to credit any overpayment, to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,

  
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